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SOLAR-WIND HYBRID POWER GENERATION USING OPTIMIZED TECHNIQUES FOR DISTRIBUTED GENERATION

Jagadisha N[1], Asma Sumaira[2], Bhavana S[3], Muneera Begum[4], Suma V[5]

Assistant professor, Department of Electrical And Electronics Engineering, GSSSIETW, Mysuru[1]

Department of Electrical And Electronics Engineering, GSSSIETW, Mysuru[2,3,4,5]

Abstract: Power generation is the process of generating electric power from other sources of primary energy. Unlike renewable energy sources, non-renewable energy sources will get depleted and also causes adverse affect on life on earth. Thus that calls for the usage of renewable energy sources for power generation. Solar and wind energy systems are omnipresent, freely available, environmentally friendly resources and they are considered as promising power generating sources due to their availability and topological advantageous of local power generations .In the present project work firstly we designed solar-wind hybrid model, made a prototype model for hybrid power generation and finally checked the suitability of the model in our college campus and results were discussed.

Keywords: solar energy, wind energy, hybrid power generation.

I. INTRODUCTION

The importance of electrical power cannot be denied because of the convenience with which it can be converted to light, heat, sound or mechanical energy with the help of simple appliances and it can be used simply by operating switches without any detrimental effect on the environment also it can be transmitted from one place to other over long distance through a thin wire. It is a universal energy which can be converted into various forms of energy. As energy can neither be created nor be destroyed but can be converted to other forms of energy. We have two forms of sources namely renewable and conventional sources. Conventional energy sources are the sources which are being used extensively such that it gets depleted and takes several million years to get replaced, like petroleum products, coal etc. Conventional energy sources are very costly and they are uncertain in their availability. They are hazardous which causes global warming, green house effect, acid rain etc.

Renewable energy sources are the sources which do not get depleted even if they are used extensively. Renewable energy sources have very strong relationship with human development. With every increasing concern of energy issue the implementation of renewable energy resources like wind, water, solar, tidal etc are becoming more and more attractive and important. In this project a stand-alone solar-wind hybrid generation system is proposed for remote and isolated areas. Hybrid generation system which is constituted by a wind power generation branch and a solar power generation branch is proposed. Solar energy is the radiant light and heat from the sun, harnessed using a range of ever-evolving technologies such as solar heating, photovoltaic, solar thermal energy, solar architecture and artificial photosynthesis. It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on the way they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy.

Passive solar techniques include orienting a building to the sun, selecting materials with favourable thermal mass or light dispersing properties, and designing spaces. The large magnitude of solar energy available makes it a highly appealing source of electricity. Solar power is the conversion of sun light into electricity, either directly using photo voltaic (PV), or indirectly using concentrated solar power (CSP). CSP systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. PV converts light into electric current using photo-electric effect. Solar power is anticipated to become the words largest source of electricity by 2050.

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Wind power is the use of air flow through wind turbines to mechanically power generators for electricity. Wind power, as an alternative to burning fossils fuels is plentiful, renewable, widely distributed, clean, produces no green house gases emissions during operation, and requires less area.

Three key factors which effects the wind power are

1. Wind speed – The amount of energy in the wind varies with cube of the wind speed, in other words if the wind speed doubles, there is eight times more energy in the wind.
2. Density of air – The more dense the air, the more energy received by the turbine. Air density varies with elevation and temperature. Air is less dense at higher elevations than at sea level and warm air is less dense than cold air. Thus turbines will produce more power at lower elevations.
3. Swept area of the turbine – The larger the swept area, the more power the turbine can capture from the wind.

As wind power and solar power are complementary since strong winds are mostly to occur during night time and on cloudy days where as sunny days are often calm with weak winds. Hence a solar-wind hybrid generation system offers higher reliability to maintain continuous power.

Schematic diagram

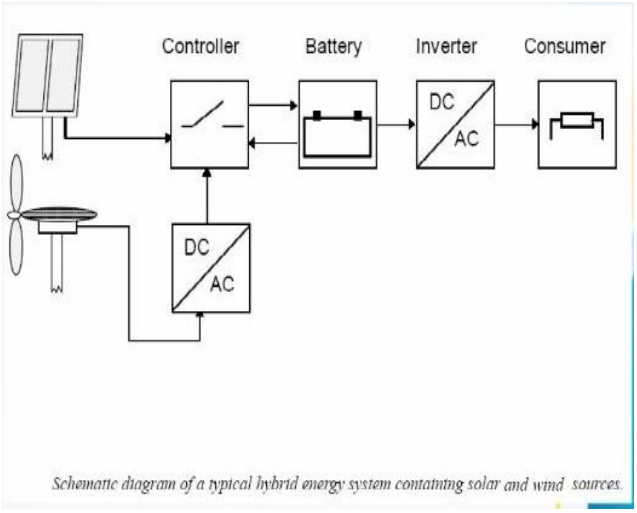

Fig 1 Schematic diagram of a typical energy system containing solar and wind sources

Solar energy is a very large, inexhaustible source of energy. That is many thousands of times larger than the present consumption rate on the earth of all commercial energy sources. Thus in principle, solar energy could supply all the present and future energy needs of the world as a continuous basis. This makes it one of the most promising non-conventional energy sources. The sun is an inexhaustible power supplier. It brings enough energy to our planet every single day to meet a full year's worth of energy for everyone on earth.

Wind energy is a form of solar energy. Wind is caused by the uneven heating of the atmosphere by the sun, variations in the earth's surface and rotation of the earth. Mountains, bodies of water and vegetation all influences wind flow patterns. Wind turbines convert the energy in wind to electricity by rotating blades around the rotor. The rotor drives the shaft which in turn rotates the electric generator.

List of components

- PV Panel
- Solar charge controller
- Aero wind generator
- Battery
- Load (Dc bulb)
- Anemometer
- Lux meter
- Temperature/ humidity meter
- Pyranometer

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Working - When solar rays falls on the PV panel, the energy in the solar rays will be converted into electrical energy due to semiconductors present in it. This energy is fed to battery. When the wind flows the blades of the aero wind generator rotates and the generator converts mechanical energy into electric power. This energy is also fed to battery. The power from both PV panel and aero wind generator will be stored in battery. The charging and discharging of battery is controlled by charge controller which prevents the damaging to the circuit. The loads we use are dc loads. The power from both solar and wind energies is Dc.

Results and discussion

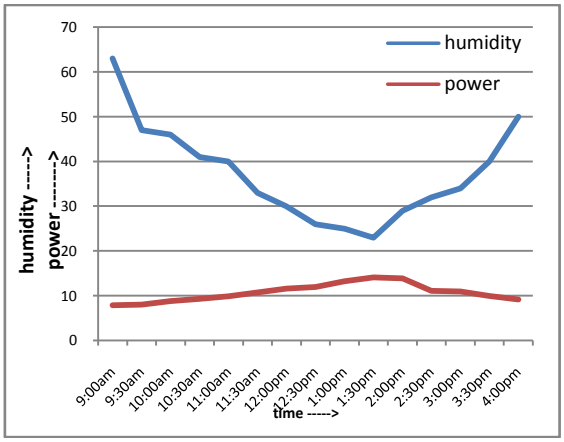

Fig 2- relation between humidity and power with respect to time

From the above figure it can be observed that the power is inversely proportional to humidity at that instant of time. This is due to effect of water content in the air.

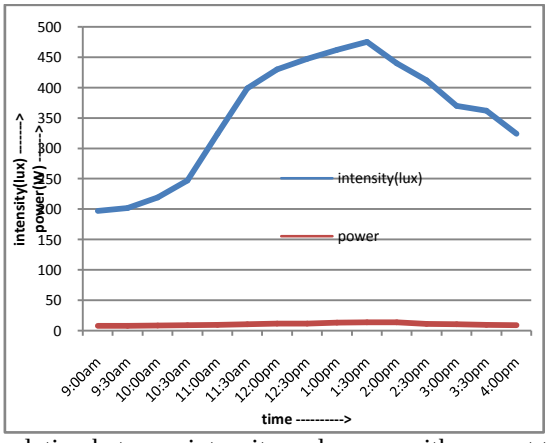

Fig 3- relation between intensity and power with respect to time

From the figure 3 it can be seen that as the intensity of solar radiation increases the power generation from the solar panel increases. This is because at higher intensity electron emission from the panel increases which leads to the increase in the current and thus the power generation increases.

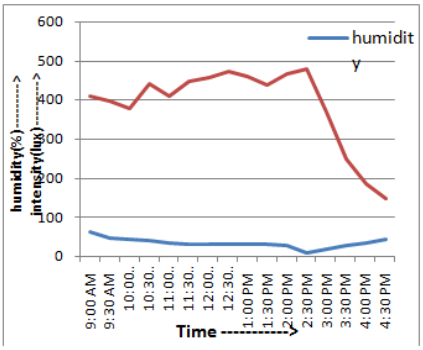

Fig 4- relation between humidity, intensity and time

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From the figure 4 it was observed that in the noon time, the humidity is low and the intensity is high. This leads to increases in power generation as indicated in figure 5.

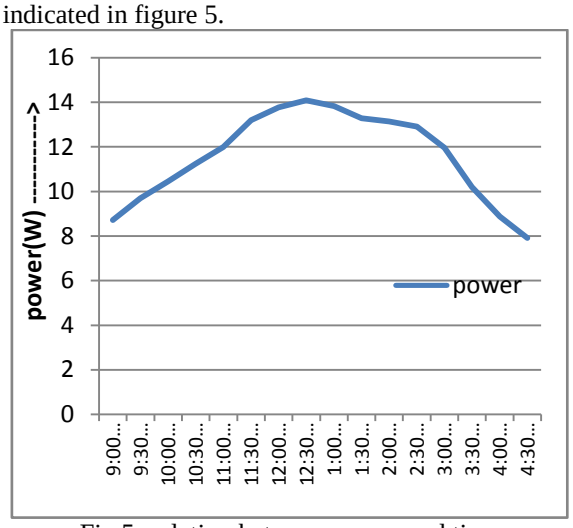

Fig 5- relation between power and time

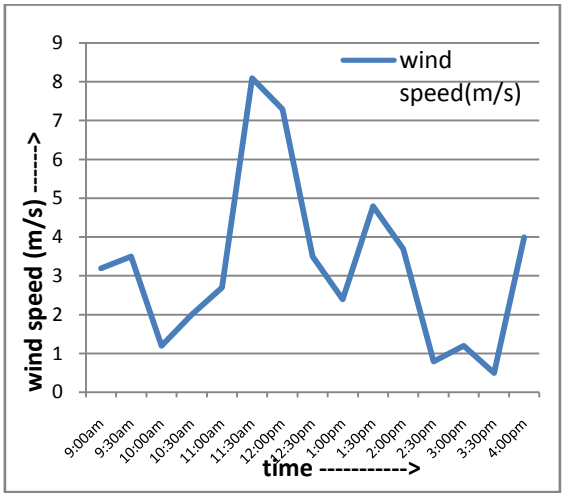

Fig 6 – relation between wind speed and time

From the figure it was observed that wind speed was relatively high during noon (around 12:00pm). It is also seen that wind speed is unpredictable compared to solar radiations.

II. CONCLUSION

The following conclusions can be made from the present work

- Power generation from solar panel is inversely proportional to humidity in that area.
- The power generation is directly proportional to the intensity.
- Maximum power can be generated when the humidity is low and intensity is high.
- Wind speed is unpredictable.
- Continuous power is made available by storing excess of energy in the lead-acid battery.
- Currently we are working with the wind model which is to be implemented by using a dynamo.

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